Robots Extracting Casualties Reduce Risk to Medics

Karen Fleming-Michael

When Soldiers are wounded and exposed to enemy fire, the first priority is getting them to safety. An Army unit at Fort Detrick, MD, is exploring how robots can extract casualties to help reduce the risk to the medics and Soldiers who might otherwise be required to extract wounded Soldiers.

COL John Lammie (right), 550th Area Support Medical Co., 3rd Infantry Division, confers with an Iraqi medic about dispensing medications during a clinical health outreach program in Subak Sur, Iraq, Dec. 26, 2005. In the near future, robots will assist medical personnel with battlefield casualty evacuation and treatment, further reducing their risk to hostile enemy fire. (U.S. Army photo by SPC Charles W. Gill, 55th Signal Co. (Combat Camera).)

Gary Gilbert, Fort Detrick Telemedicine and Advanced Technology Research Center (TATRC), first started looking at the robot option when he combined his experience as a ground ambulance company commander in Germany with his doctoral training in artificial intelligence and robotics.

"If you look at the data on medics awarded the Medal of Honor, most of those killed in action were in the process of rescuing or caring for wounded Soldiers under fire," he said. "The same is true when one Soldier helps another injured buddy. It seemed to me that using robots could help reduce those losses."

His idea of robots performing casualty extractions makes more sense today than ever before. "With the increased threat of weapons of mass destruction, chemical and biological weapons, booby-trapped IEDs [improvised explosive devices] and urban combat, medics are ever more likely to be exposed to risks," Gilbert said. "This increased exposure might not be necessary if robots could be used in some of those dangerous situations."

Looking to the Future

The Army has mandated that one-third of its vehicles be unmanned by 2015, and Gilbert believes robotic extraction platforms fit this bill. "If the medics don't do their share [to move toward unmanned vehicles], then more of that third falls on the Army combat and other combat support elements," he said.

Robot program prototypes were put through their paces Aug. 29, 2005, in a field near TATRC, including the following:

- Robotic Evacuation Vehicle evacuates patients from where the medic stabilizes the Soldier to a treatment site.
- Battlefield Extraction-Assist Robot (BEAR) moves patients from the point of injury to the medic. Both this robot and the evacuation vehicle allow medics to use remote controls to get Soldiers out of harm's way. However, this technique requires the wounded Soldier to roll onto a sled before medics or a larger robot can drag him back to safety.

Daniel A. Theobald, Vecna President, demonstrates a BEAR casualty extraction simulation. (U.S. Army photo by Lori DeBernardis.)

CPT Chad Umbel, 6 feet tall and 240 pounds, from the Fort Detrick Fire and Emergency Services, was picked up effortlessly by the Robotic Emergency Medical and Danger Detection vehicle, developed at St. Francis University and demonstrated recently at Fort Detrick's TATRC. (U.S. Army photo by Chuck Dasey.)

- Battlefield Evacuation and Recovery Humanoid Robot safely picks up and extracts an injured Soldier on the battlefield, eliminating the requirement for Soldiers to roll onto a sled.
- Robotic Emergency Medicine and Danger Detection Robotic Vehicle is being designed to respond to civilian natural disasters and acts of terrorism in rural areas where medical resources are limited. The vehicle uses items such as an unmanned aerial vehicle (UAV), a casualty extraction litter payload system, robot scouts, a hazardous gas and radiation detection system, and a remote casualty location device.

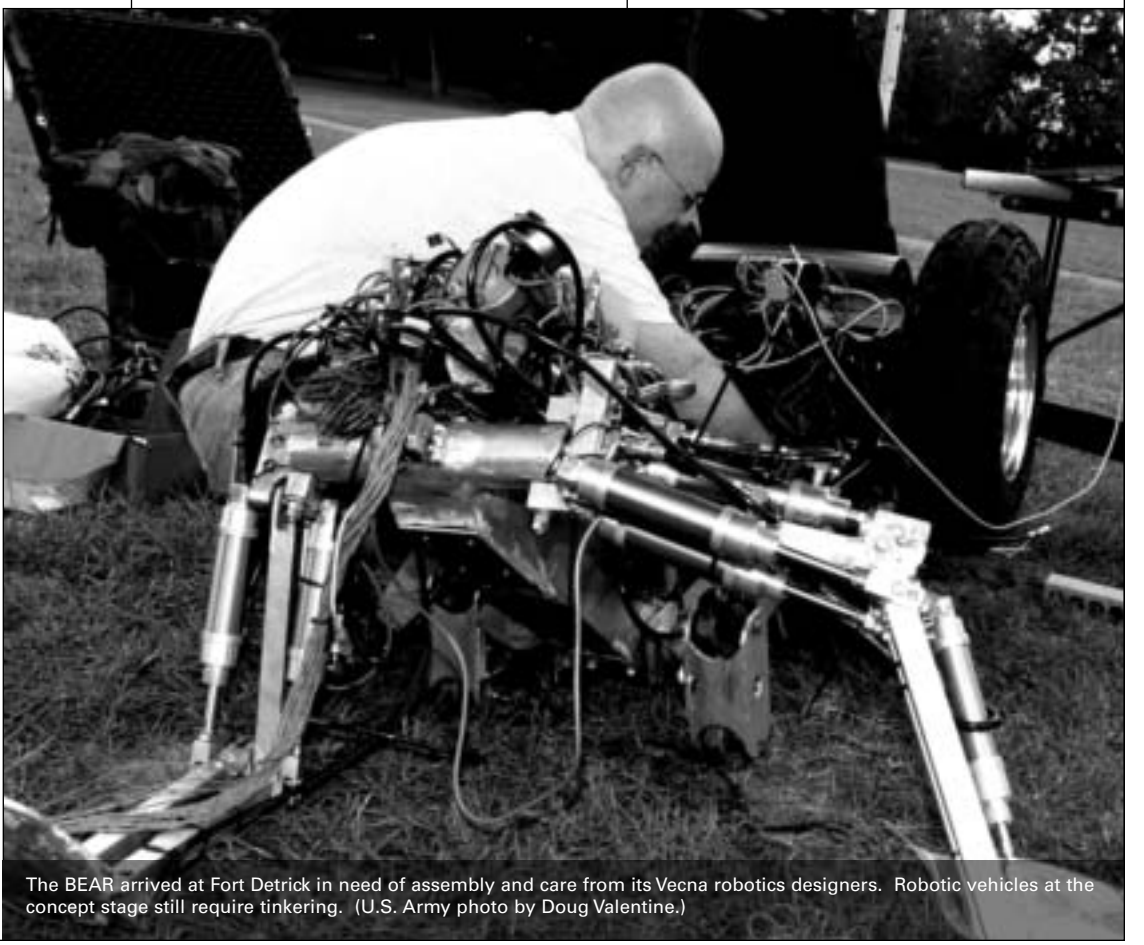
Another approach uses UAVs for biosurveillance, medical response command and control, and imaging. A final prototype uses robot controller devices mounted on an M4 rifle or a glove hand-signal robot controller. However, there are challenges with robotic evacuation because, at the heart of it, robots are machines, not humans.

Maintaining the Human Touch

Robots don't deal with the unknown very well," Gilbert remarked. "As sophisticated as their programs are, they still don't deal with plans that fail when confronted with unforeseen problems. Right now, you could not be sure that robots put out on a battlefield with human Soldiers might not accidentally run over or bash into their human buddies."

Replacing a medic with a machine invariably leads to the question of a robot's ability to comfort a wounded Soldier. "We've got to maintain the psychology and the warmth of the human touch for these patients if we are going to use robots," Gilbert said. "We have installed a telemedicine screen on the ceiling of the [evacuation vehicle's] patient compartment, so when patients are being transported, they can actually see and talk to a human medical provider and that provider can give some level of support and care, even if they're not physically present. For now, however, we will continue to have human attendants on board, even 'unmanned vehicles' whenever patients are being transported."

Regardless of the challenges, Gilbert is determined to push forward. "I hope that before I retire I see that concept adopted by an Army acquisition program and some of these capabilities make it into the field," he said. "The ultimate success would be to see these robots actually save Soldiers' lives while also preventing unnecessary losses of our brave medics."



The BEAR arrived at Fort Detrick in need of assembly and care from its Vecna robotics designers. Robotic vehicles at the concept stage still require tinkering. (U.S. Army photo by Doug Valentine.)

Field Medics to Get Improved Sterilizer

Sterilizing medical instruments in the field can be tricky. It is so tricky that forward surgical teams (FSTs) — the first stops for Soldiers who need surgery — don't do it. Because FSTs are mobile, they can't accommodate the weight, size or power requirements of current field sterilizers.

"FSTs should have sterilization capability," said LTC Thomas Winthrop, Chief of Central Material Service, which does all the sterilization work for the Walter Reed Army Medical Center. "I would think if they were going to add anything, they would add a sterilizer."

Phygen, a Minnesota-based company, is developing a new plasma sterilizer at the U.S. Army Medical Materiel Development Activity (USAMMDA) at Fort Detrick, MD that may be able to provide sterilizers to FSTs in coming years. Plasma is a highly ionized gas, like the gas in a fluorescent-light tube. The new sterilizer uses plasma to energize a hydrogen peroxide vapor and kill microorganisms. "It has multiple killing techniques," Arnold said. "It ionizes the oxygen found in normal air and the hydrogen peroxide to kill bugs." And you have to kill lots of microorganisms to sterilize something to Food and Drug Administration standards. "If you had a million bacteria, you could have one left for it to be considered sterile."

Of steam, gas, chemicals and plasma, steam is Winthrop's favorite sterilization method. He used "Big Bertha" steam sterilizers in the field and saw their value. "There's no one answer for sterilizing most things but for the field, steam is really the only answer. Steam penetrates, the other stuff doesn't." Arnold agreed that steam sterilizers have earned their bragging rights, and said the new technology will supplement steam, not replace it.

The "Big Bertha" steam sterilizer has been around since the latter part of the Vietnam War but FSTs can't use them because they're too heavy and need too much power. A new plasma sterilizer is being developed for FSTs. (U.S. Army photo by LTC Thomas Winthrop.)

Arnold would like the new plasma sterilizer to replace the chemical glutaraldehyde that FSTs currently use. Because glutaraldehyde is used to glue cells on slides, it sticks to instruments and dulls them over repeated cleanings. "That's why instruments get grungy when you clean with glutaraldehyde," he said.

The new sterilizer has other benefits useful for FSTs. It takes from 20 to 58 minutes to sterilize whatever is in its chamber and, because it operates at low temperature, users don't have to wait for instruments to cool before use. And Arnold said the new sterilizer would not present any environmental concerns. The hydrogen peroxide vapor breaks down into water vapor and oxygen, and the plasma turns back into air when the electricity is turned off.

The sterilizer's weight will depend on how large it is, but it will be substantially lighter than conventional ones because it won't need high-pressure boilers and pressure chambers. The technology is also scalable, so it can have a small or large diameter. The new sterilizer will use less power, too. "You won't have to bring along as many generators. You don't burn as much fuel," Arnold said.

The plasma sterilizer will need electrical equipment to create the high voltages used to create the plasma and will have a vacuum pump. It will also need a basic computer to remain reliable. "Anything on a computer is going to be a problem in the field, no matter what," Winthrop said, adding that most modern equipment has computers so getting around them isn't likely.

Phygen expects to have a sample of the new sterilizer within the next two years. Arnold said the Army will help the company work through some of the military-unique requirements. "Most manufacturers have no idea how bad the environment is out there," he said.

KAREN FLEMING-MICHAEL is a Public Affairs Officer with the U.S. Army Medical Research and Materiel Command. She has a B.A. in English literature from the University of Maryland and an M.S. in public administration from Auburn University. She has worked as an editor and public affairs specialist for 16 years.